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No. 77

September, 1964

RESOURCE MANAGEMENT REPORT

ONTARIO

DEPARTMENT OF LANDS AND FORESTS

Hon. A. Kelso Roberts, Q.C.
Minister

F. A. MacDougall
Deputy Minister

(These Reports are for Intra-Departmental Information
and Not for Publication)

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MORTALITY OF HATCHERY BROOK TROUT ATTRIBUTED TO VORTICELLA GLOBULARIS

by
Paul Graf
Assistant Hatchery Manager, Hill's Lake Hatchery

Abstract

An increase in mortality of fingerling brook trout was encountered at Hill's Lake Hatchery during the early summer of 1958. Examination of these fish disclosed an unusually high incidence of Vorticella globularis. Treatment of the fish to control this organism resulted in the recovery of the fish.

Introduction

Routine examinations of fish losses at Hill's Lake Hatchery are continually made to facilitate control of pathological organisms. The protozoan Vorticella sp. was frequently observed, but according to available literature, was not considered to be harmful. On several occasions large numbers of Vorticella were found on brook trout and these instances were accompanied by high mortality.

They were first discovered in the early summer of 1958. These organisms were seen attached to the fins, gills and body of brook trout. Only fingerlings and poor quality yearlings heavily infested with Vorticella displayed symptoms, and no known pathogens were found.

A pathologist, Dr. A. Dechtiarenko, from Maple, visited the hatchery in November, 1960, and confirmed the identification of the organism as the protozoan Vorticella globularis.

Treatment which removed the organisms also brought about the recovery of the fish.

Description of Vorticella

Vorticella is a bell-shaped organism with a relatively long contractile stalk (Fig. 1). The open end of the bell has a thickened edge (peristome) with a fringe of cilia, characteristic of the Class Ciliata to which Vorticella belongs. The only readily seen internal structures are the crescent-shaped macronucleus and food vacuoles.

Vorticella is an ecto-commensal normally found attached to algae, but also to Cyclops and other Crustacea. This is the first record of this occurrence on fish. The protozoan feeds on bacteria carried to the mouth by water currents caused by ciliary action.

It is not known precisely how mortality is caused by Vorticella. However, it is possible that their presence in large numbers on the gill filaments in some way interferes with gas exchange.

Symptoms

Pathological conditions occurred only in fingerlings and small yearling brook trout. Several symptoms were apparent. The fish had a tendency to rub themselves against the side and bottom of the hatchery trough. They also were seen breaking the surface of the water with their dorsal fins. The skin turned cloudy and appeared slightly lighter in colour than in healthy fish.

The only positive way of diagnosis is by microscopic examination.

Treatment

After Vorticella were observed on the fish, the problem of control was undertaken. Since the protozoan was not a known fish pathogen, no methods of control were prescribed in the literature.

I experimented with formaldehyde, lysal dip, acetic acid dip, and Pyridyl mercuric acetate (P.M.A.). All treatments were tried on selected groups of infected fish and showed varying degrees of success. Formaldehyde showed the best results.

1. Formaldehyde 1 : 4,000 for one hour.
2. P.M.A. 1 : 200,000 for one hour.

I recommend that Formaldehyde should not be used for treatment if swelling of the gill filaments is observed.

Conclusions

From observations made at Hill's Lake Hatchery, it appears that Vorticella may become a pathogen in young brook trout. The damage caused by these organisms is relatively minor and mortality can be limited by prompt diagnosis and treatment. It appears that contrary to current literature, Vorticella globularis can be harmful to fish.

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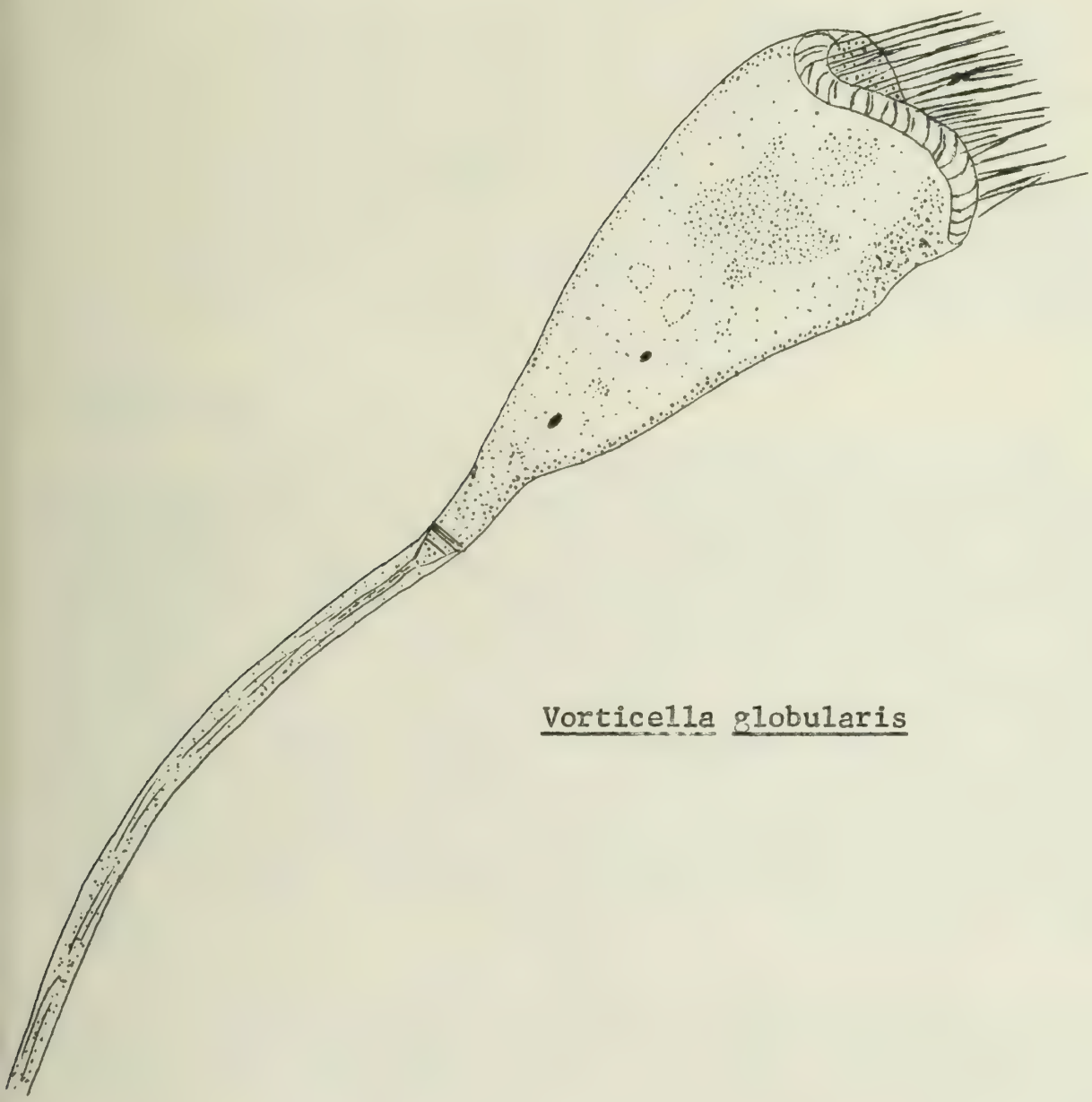

Vorticella globularis

THE FRENCH RIVER CREEL CENSUS 1963
WITH A SUMMARY OF THE YEARS 1961-1963

by
R. Espaniel, J. Sheppard and D. I. Gillespie

Abstract

A creel census on the French River was carried out for the third consecutive year in 1963. Smallmouth bass predominated the catch closely followed by walleye. Pike and perch comprised less than 15 per cent of the catch. During the 127 day census period 1775 anglers caught 8331 fish. The season's fishing success was 91.4 fish per 100 rod-hours and the average harvest per fisherman for the season was 4.7 fish. Results of the 1963 census and those of 1961 and 1962 are compared.

Introduction

A creel census has been carried out on the French River since the summer of 1961. Basically, the data collected have been comparable in content, fish caught by species, number of anglers and total fishing effort, but each year there has been a consideration of particular aspects of the fishery. In 1961, the initial year of the census, we considered a description of the waters, a comparison of the quality of angling in the French with other waters in the Sudbury District, and a description of the quality of fishing in two lakes adjacent to the river (Sheppard, 1962). In 1962 with more detailed data available, a comparison of guided and unguided resident and non-resident fishermen was made, the description of the quality of fishing in adjacent lakes was expanded, the data were considered to evaluate competition between anglers in the same boat and walleye year class strength was commented upon (Espaniel, 1963).

This year, 1963, the information has been collected to allow an analysis of the utilization of the fish caught viz. fish caught, fish eaten and fish kept. We have also brought together the data of all three years as a final comparison of the fishery.

Methods Used

The methods used in collecting the data were the same as those described by Sheppard (op. cit.) and used by Espaniel (op. cit.)

1963 Data

Records were kept on the four main species of fish caught in the French River -- walleye (Stizostedion vitreum) smallmouth bass (Micropterus dolomieui) northern pike (Esox lucius) and yellow perch (Perca flavescens). The latter species plays a relatively insignificant role in the catch of this census. The walleye made up 42.6 per cent of the catch (3545 fish), the bass 44.7 per cent (3722 fish), the pike 12.1 per cent (1006 fish) and the perch .7 per cent (58 fish). Fewer walleye were taken in 1963 compared to the other years, more bass and fewer pike.

The four species totalled 8331 fish during the 127 day census period. These fish were caught by 1775 anglers who averaged 5.1 hours fishing or a total of 9113 angling hours. The season's fishing success was 91.4 fish per hundred rod-hours and the average harvest per fisherman for the season was 4.7 fish. During a period of apparent increased availability of bass (in early August) the catch per unit effort rose to 127.7 fish per 100 rod-hours. The season's low was recorded in early October (54.6 fish per hundred rod-hours).

Records were kept on the utilization of the catch. Table 1 provides a temporal consideration of this information. The data beside the heading "caught" go without need of explanation. The "eaten" data represent fish eaten as shore lunches and the "kept" data represent fish taken back to the lodge to be eaten or packed for shipment to the angler's home.

Table 11 provides the season totals expressed as percentages. Forty-two per cent of all the fish caught were consumed, providing a C.U.E. of 38.4 fish, considered suitable for consumption, per hundred rod-hours. While walleye and bass were relatively comparable in total numbers caught, the consumption of the former was almost double the consumption of the latter. The pike consumed were generally of trophy size compared to those released and angling for this species was primarily for the sport involved in landing the fish.

A temporal consideration of the angling success and effort is presented in Table 111. The catch success increases from the late spring to a peak in mid-summer then tails off to a low in early fall. In 1962, although the catch success was generally higher throughout the season, a similar trend is to be noted, but the peak period is about two weeks ahead of the 1963 peak.

A Comparison of the Data Collected in 1961, 1962, 1963

The duration of the census period has varied somewhat during the three years that we have worked on the French River. In 1961 the work was carried out between July 17 and October 2 for 52 census days, between May 12 and October 6 for 144 census days in 1962, and between June 3 and October 13 for 127 census days in 1963. During these three years there has been a decline in the C.U.E. from the high of 122.6 in 1961 to the low of 91.4 in 1963. Likewise there has been a decline in the angler take from 5.7 fish in 1961 to 4.7 in 1963. Table IV provides that three year comparison of catch, effort, C.U.E. and catch per angler.

It is interesting to compare the species composition of the creels for the three year period. Tables V and Va have been constructed to provide this information in number and per cent form. During the first two years the per cent composition of walleye and bass in the creel remained relatively constant at about 47 and 37 per cent, respectively. In 1963, however, it appears that there was a considerable drop in the walleye portion of the creel and a correspondingly large increase in the bass creel.

However, if from the 1962 and 1963 data, comparable periods June 1 to September 30 are examined it will be seen that the change is due primarily to a drop in the walleye harvest. Tables VI and VIa have been constructed to show this. The angling pressures and efforts for these two intervals are remarkably similar. Only 22 more anglers were interviewed in 1962 and only 56 more hours of effort reported. If only walleye and bass are considered as the years' catch, it will be seen that in 1962 the harvest was 52.8 per cent walleye and 47.2 per cent bass while in 1963 the percentage harvest is reversed (47.2% walleye and 52.8% bass). If it is assumed that equal time is spent angling for walleye and for bass then from Table VIa it will be seen that the C.U.E. for bass has remained relatively constant while the walleye C.U.E. has dropped about 20 per cent.

Summary

1. The French River creel census was carried out for the third consecutive year in 1963.

2. Bass predominated the catch in 1963 closely followed by walleye. Pike and perch made up less than 15 per cent of the catch.

3. The 1963 angling success was 91.4 fish per hundred rod-hours and the average harvest was 4.7 fish per angler.

4. Records were kept on the use made of the fish caught. 42 per cent of the fish caught were consumed (the balance 58 per cent were returned to the water.) That portion of the catch which was kept, provided a C.U.E. of 38.4 fish per hundred rod-hours.

5. Angler preference was apparent in the eaten and kept data. About twice as many walleye were eaten or kept for later consumption than were bass.

6. A seasonal trend in the C.U.E. for 1963 was seen to be similar to that of 1962 with the peak availability about two weeks ahead of 1962.

7. During the three years that the French River creel census has been in effect the census period has varied in time from July 17 to October 2 to May 12 to October 6 and in length from 52 days to 144 days.

8. The C.U.E. for the three years has been 1961 --- 122.6 fish per hundred rod-hours, 1962 --- 105.4 fish per hundred rod-hours and 1963 --- 91.4 fish per hundred rod-hours. Similarly the catch per angler has shown a downward trend of 5.7 to 5.4 to 4.7 fish per angler.

9. When comparable census periods of June 1 to September 30 for 1962, and 1963 are used the per cent composition of the two major species walleye and bass are seen in a better light. Tables V and Va suggest that the walleye catch has dropped while the bass catch has increased. This is only half so -- Tables VI and VIa indicate that the former species has declined but the latter has remained relatively constant.

Discussion

Since 1960 the creel census has been one of this District's most important tools of inventory and public relations. About thirty different waters have been assessed qualitatively in the four years of this program. The results of these projects have served to set standards of quality for fishing in this District and have enabled us to answer some of the questions raised by interested sportsmen.

While answering some of the sportsmen's questions this work has created problems we have yet to solve. One of the questions we ask ourselves is when should we terminate the census for a given water? -- after two years? three years? five? -- never? Another is what sort of information should we collect and how deep should we go in analysing the data collected? The

question raised by some is: Why bother collecting information if you cannot do anything to alter the conditions that Nature has created and man, inadvertently, unconsciously, or recklessly has altered? Censuses have been termed the statisticians delight and the sorrow of practical men.

We have tried to maintain an affirmative attitude in our census work in the hopes that the information we have collected may ultimately serve to provide the means for assuring the "best possible for the most." However with an increase in projects throughout the District, it has become necessary to alter our program from time to time based on the existing pressures and needs. With all this in mind we have decided to terminate the French River creel census in 1963 with the hopes that in the near future we will again be able to sample the anglers' catch.

The French River work has provided us with many interesting facts and fancies. With the exception of the North Channel and Georgian Bay waters it is probably Sudbury District's most heavily utilized fishery. On the basis of our creel census and other information collected over the past four years we estimate that the French River between mid-May and mid-October, in a normal year, supports a fishery of 400,000 angler-days (a conservative estimate) and produces about 1,500,000 fish of six species. The walleye and the smallmouth bass are the major species taken in the French with the northern pike being a distant third. Fluctuations in water levels during the spawning season and to some degree during the angling season appear to be of some considerable importance in determining the quality and quantity of the fishery. Year class strength of walleye and northern pike seems to be most seriously affected by spring water fluctuations. Twenty-four hour fluctuations of six inches in the river's level are normal and twelve inch changes are not uncommon. Spawning fish are frequently trapped during the more sudden drops and spawn (particularly pike) are periodically left to rot after receding waters. Many sportsmen seem to be creatures of habit and persist in fishing in the same "hole" where they had good fishing last month despite the fact the river has dropped three feet. Consequently their catch success drops.

Hughson and Sheppard (1962) while carrying on their Scuba investigations record a vertical movement of walleye in the French River which we feel is associated with the thermal conditions of the river and therefore the water level. They also point out that, at certain times of the year, when they located a school of walleye and advised anglers of their presence there was little response of the walleye to the bait provided by the fishermen suggesting perhaps physiological changes in the fish with temperature changes.

The 1962 data showed rather conclusively that a knowledge of the river and perhaps of the fish behaviour significantly increases the harvest. A difference of almost 50 fish per hundred rod-hours was noted between guided fishermen and fishermen who did not employ guides. Similarly we have found that many resident anglers and visiting anglers familiar with the river have experienced a far greater degree of success than the casual visitors.

There appears to be a difference in the selectivity of residents and non-residents. The latter group shows little preference between walleye and bass whereas residents take about two walleye for every bass. The non-resident catch per unit effort also exceeds the resident harvest by about 15 fish per hundred rod-hours.

The three years of data suggest there is a seasonal trend in the C.U.E. From the commencement of fishing in the spring the success increases to a peak somewhere about late July to early August and then declines to the close of the fall fishery. Very little winter fishing is carried out on the French River. During the three years of the census there appears to have been a decline in the C.U.E. and the harvest per angler. Species composition remained relatively stable during the first two years of the census but changed in 1963. The walleye portion of the creel dropped considerably in 1963 and perhaps contributed most to the reduction in the C.U.E.

Records kept on the disposition of the fish caught indicate that about 40 per cent of the fish are kept to be eaten or taken back to the camp for shipping. This produces a C.U.E. of desirable fish of about 38 fish per hundred rod-hours. There is also a preference for the species of fish eaten or kept by the angler. Almost twice as many walleye were retained for consumption compared to bass. Relatively few pike were eaten and fewer were taken back to camp.

The French River provides about 25 spawning locations, above Recollect Falls, for walleye and numerous sites for pike and bass. Natural barriers along the river's course precludes the probability that Georgian Bay fish serve as the basis for the French River fishery. The major problem with the French River appears to be in stabalizing the river levels and thereby preventing the large primary losses of spawn that have been witnessed in the past. An effort has been made to co-ordinate the operation of the Lake Nipissing dam with the spawning seasons of the French River.

Acknowledgments

We would like to acknowledge with thanks, the assistance provided us by Mr. C. Shortts and the guides of Lift the Latch Lodge.

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TABLE 1: RELATIVE UTILIZATION OF FISH CAUGHT BY ANGLING PERIODS IN THE FRENCH RIVER 1963

Angling Period		Walleye	Bass	Pike	Perch	Total
June 1-15	Caught	104		78	1	183
	Eaten	51		12		63
	Kept	15		17		36
16-30	C	480	55	130	4	669
	E	281	9	19		309
	K	55	7	10		72
July 1-15	C	463	318	222	22	1025
	E	201	96	14		311
	K	82	36	10		128
16-31	C	628	606	191		1425
	E	256	116	12		384
	K	57	50	12		119
Aug. 1-15	C	411	1177	80	6	1674
	E	166	203	12	2	383
	K	72	130	10		212
16-31	C	295	674	105	2	1076
	E	143	126	17		286
	K	33	57	12		102
Sept.1-15	C	291	551	88	12	942
	E	160	122	6		288
	K	22	41	2		65
16-30	C	586	264	102	11	963
	E	261	77	2		340
	K	127	24			151
Oct. 1-14	C	287	77	10		374
	E	125	19	3		147
	K	99	5	1		105
TOTAL	C	3545	3722	1006	58	8331
	E	1644	768	97	2	2511
	K	566	350	74		990

TABLE II: PER CENT UTILIZATION OF FRENCH RIVER FISH 1963					
	Walleye	Bass	Pike	Perch	Total
Eaten	46.4%	20.6	9.6	3.4	30.1
Kept	16.0%	9.4	7.4		11.9
TOTAL CONSUMPTION	62.4%	30.0	17.0	3.4	42.0

TABLE III: A TEMPORAL CONSIDERATION OF ANGLING DATA FRENCH RIVER 1963.

Angling Period	Total Fish	Anglers	Hours	Effort	Fish/100 rod-hrs.
June 1-15	183	38	194	5.1	94.3
16-30	669	170	904	5.3	74.0
July 1-15	1025	231	1240	5.4	82.7
16-31	1425	249	1357	5.4	105.0
Aug. 1-15	1674	247	1311	5.3	127.7
16-31	1076	223	1152	5.2	93.4
Sept.1-15	942	192	927	4.8	101.6
16-30	963	287	1343	4.7	71.7
Oct. 1-14	374	138	695	5.0	54.6
TOTAL	8331	1775	9113	5.1	91.4

TABLE IV: COMPARATIVE ANGLING DATA FRENCH RIVER 1961, 1962, 1963.

Year	Total Fish	Anglers	Hours	Fish/100 Rod-Hrs.	Fish/Angler
1961	4944	867	4032	122.6	5.7
1962	10022	1857	9512	105.4	5.4
1963	8331	1775	9113	91.4	4.7
TOTALS or AVERAGES	23297	4496	22657	102.8	5.2

TABLE V: COMPARATIVE CATCH DATA FRENCH RIVER
1961, 1962, 1963.

Year	Walleye	Bass	Pike	Perch	Total Fish
1961	2318	1840	556	230	4944
1962	4801	3648	1491	82	10022
1963	3545	3722	1006	58	8331
TOTALS	10664	9210	3053	370	23297

1961 52 Day Census Period

1962 144 Day Census Period

1963 127 Day Census Period

TABLE Va: PER CENT CATCH DISTRIBUTION, FRENCH RIVER
1961, 1962, 1963.

Year	Walleye	Bass	Pike	Perch	Total Fish
1961	46.9%	37.2%	11.2%	4.7%	21.2%
1962	47.9%	36.4%	14.9%	.8%	43.0%
1963	42.6%	44.7%	12.1%	.7%	35.8%
TOTALS	45.6%	39.5%	13.1%	1.6%	

TABLE VI: A COMPARISON OF BASS AND WALLEYE ANGLING FRENCH RIVER, 1962, 1963, for Comparative Angling Periods, June 1 - Sept. 30.

	Walleye	Bass	Pike	Anglers	Hours
1962	4122	3680	1346	1659	8484
1963	3258	3645	996	1637	8428

TABLE VIa: A PER CENT COMPARISON OF BASS & WALLEYE ANGLING FRENCH RIVER, 1962, 1963 for Comparative Angling Periods, June 1 - Sept. 30.

	Walleye/100 rod-hrs.	Bass/100 rod-hrs.	Wall/100angl.	Bass/ 100Ang.
1962	48.6	43.4	248.5	221.8
1963	38.7	43.3	199.0	222.7

GROUSE HUNTING IN PARRY SOUND DISTRICT

1963

by
C. A. Rettie
Assistant Senior Conservation Officer

Abstract

Game bag census data collected during the 1963 grouse season (September 21 - December 14) showed only slight improvement in hunter success over the previous year with a kill of 39.3 grouse per 100 hours spent in the field on foot. Hunters cruising the roads in automobiles and then stalking on foot, birds sighted from the car accounted for 3.9 birds per 100 miles of driving or 25.9 birds per 100 hours time, which is less than the previous year. A total of 444 specimens of wings and/or tails of ruffed grouse showed the ratio of adult females to juveniles to be 100:392. Forty-nine birds were examined internally for positive sexing. Twenty-three male birds thus examined had an average central tail feather length of 6-9/16 inches and twenty-three female birds had an average central tail feather length of 5-6/16 inches. The three remaining internally sexed birds had tail feathers still in the blood quill stage and were therefore not included in this sample.

General

Conservation Officers on routine patrols and many individual co-operators submitted data on 294 hunting trips involving 489 man-hours of hunting on foot and 525 man-hours (3452 miles driven) of road hunting, plus 444 wings and/or tails for sex and age determinations.

From this information the following tables have been prepared for comparison with the records of previous grouse hunts.

TABLE I

GROUSE HUNTING 1963

Hunting on Foot

	# Reports	# Hunters	Man-Hours	Birds Flushed		Birds Shot	
				Total	/100 Man-Hrs.	Total	/100 Man-Hrs.
Sept. 21-30	29	41	122.5	103	84.1	39	31.8
Oct. 1-31	78	129	302.0	336	111.3	130	43.0
Nov. 1-30	19	20	27.5	32	116.4	16	58.2
Dec. 1-14	8	15	37.0	20	54.1	7	18.9
Total	134	205	489.0	491	100.4	192	39.3

TABLE II

Hunting from Automobile

	# Reports	# Hunters	Miles Driven	Man-Hours	Birds Flushed			Birds Shot		
					Total	/100 Mile	/100 Man-Hr.	Total	/100 Mile	/100 Man-Hrs.
Sept. 21-30	36	60	907	138.0	90	9.9	65.2	20	2.2	14.5
Oct. 1-31	108	198	2410	376.0	296	12.3	32.7	114	4.7	30.3
Nov. 1-30	12	13	109	8.5	1	0.9	11.8	1	.9	11.8
Dec. 1-14	4	4	26	2.5	5	19.2	200.0	1	3.8	40.0
Total	160	275	3452	525.0	392	11.4	74.7	136	3.9	25.9

TABLE III

Hunting Success (Foot and Automobile Combined) per Hour

	# Reports	# Hunters	Man-Hours	Birds Flushed		Birds Shot	
				Total	/100 Man-Hrs.	Total	/100 Man-Hrs.
Foot	134	205	489	491	100.4	192	39.3
Auto	160	275	525	392	74.7	136	25.9
Total	294	480	1014	883	87.1	328	32.4

TABLE IV

Seven Year Record of Hunter Success

	1957	1958	1959	1960	1961	1962	1963
Sample Size (Man-Hours)	1932	2082	701	636*	366*	454*	489*
Kill per 100 Hours	19	27	39	28	13	37.7	39.3

* Figures do not include automobile hunting.
Those for other years do.

Age and Sex of the Kill

Table V gives the results of the examination of the 444 specimens of wings and/or tails. The criteria described by Hale et al (1954) was employed and data recorded and sex determined as described by Rettie (1962).

Seventy-two birds were recorded as having the central tail feather in the blood quill stage, of which the last bird thus recorded was shot on November 4. These specimens were of necessity sexed by tail band pattern since the feathers were still growing. Where this was not possible (6 specimens) as in the case of intermediate banding the specimens were unsexed.

Of the remaining 372 specimens, 57 were classified as having intermediate tail bands and therefore sexed solely according to central tail feather length. The remaining 315 specimens were also sexed by central tail feather length but in this instance measurement could be checked with tail band features. Fifteen specimens or 4.8 per cent did not concur in both tail band and measurement using the criteria for sexing Wisconsin ruffed grouse as described by Hale et al (1954). Ten of these fifteen specimens or 3.2 per cent of the total were judged to have male banding, but measured and recorded as females.

TABLE V

AGE AND SEX OF THE RUFFED GROUSE KILL

Adult Males	Juvenile Males	Adult Females	Juvenile Females
78	122	73	144
Unsexed Juveniles	20	Unaged Males	0
Unsexed Adults	7	Unaged Females	0
		Total Specimens	444

Sex Ratio:

Males to Females 200:217 or 100:109

Age Ratio:

Adults* to Juveniles* 158:286 or 100:181
Adult Females to Juveniles 73:286 or 100:392

* Includes 20 Unsexed Juveniles and 7 Unsexed Adults

TABLE VI

SEVEN YEAR RECORD OF SEX AND AGE RATIOS

	1957	1958	1959	1960	1961	1962	1963
# Specimens Examined	165	647	362	480	121	419	444
Males to Females	100:70	100:110	100:110	100:70	100:80	100:82	100:109
Adult to Juvenile	100:120	100:140	100:250	100:210	100:400	100:260	100:181
Ad. Female to Juvenile	100:290	100:360	100:510	100:640	100:1360	100:800	100:392

TABLE VII

SEASONAL COMPARISON OF AGE RATIO

	Total Aged	Total Adults	% Adults/Total
Birds Shot Sept. 21-Oct. 11 (Before Leaf Fall)	193	56	29.0%
Birds Shot Oct. 12 - Dec. 14 (After Leaf Fall)	251	102	40.6%

Positively Sexed Birds

The forty-nine birds listed in table VIII were sexed internally by our officers in the field. The three female specimens still in the blood quill stage were deleted from figures establishing average length of retrice.

All positively sexed specimens this year fell within the limits for establishing sex by central tail feather length as per the Wisconsin criteria.

TABLE VIII RETRICE LENGTH OF RUFFED GROUSE OF KNOWN SEX, 1963

Specimen #	Age	Sex	(Inches) Tail Length	Township	Date
10	Juvenile	Female	5-5/16	McConkey	Sept. 21
11	Juvenile	Male	6-5/16	Hardy	Sept. 21
12	Juvenile	Female	5-5/16 (Blood)	Hardy	Sept. 21
15	Juvenile	Female	3-2/16 (Blood)	Laurier	Sept. 21
18	Adult	Male	6-13/16	Hagerman	Sept. 21
29	Adult	Male	6-6/16	Monteith	Sept. 23
30	Juvenile	Male	6-7/16	Monteith	Sept. 23
44	Juvenile	Female	5-4/16 (Blood)	Spence	Sept. 25
175	Adult	Male	6-13/16	Wallbridge	Oct. 12
201	Juvenile	Female	5-5/16	Spence	Oct. 14
202	Adult	Female	5-12/16	Spence	Oct. 14
230	Adult	Male	7-2/16	Hardy	Oct. 15
231	Adult	Female	5-9/16	Hardy	Oct. 15
246	Juvenile	Female	5-4/16	Nipissing	Oct. 16
255	Juvenile	Male	6-1/16	N. Himsworth	Oct. 17
277	Adult	Male	6-7/16	Ferguson	Oct. 19

TABLE VIII
Cont'd

Specimen #	Age	Sex	(Inches) Tail Length	Township	Date
295	Juvenile	Male	6-6/16	McDougall	Oct. 22
296	Adult	Female	5-7/16	Foley	Oct. 22
305	Juvenile	Male	6-2/16	Foley	Oct. 23
306	Adult	Female	5-4/16	McDougall	Oct. 24
316	Juvenile	Male	6-5/16	McKellar	Oct. 26
317	Juvenile	Female	5-7/16	McDougall	Oct. 26
328	Adult	Female	5-6/16	McKellar	Oct. 31
329	Adult	Male	6-11/16	Christie	Oct. 31
331	Juvenile	Male	6-10/16	McDougall	Oct. 31
332	Juvenile	Female	5-5/16	McDougall	Oct. 31
336	Juvenile	Male	6-6/16	McKellar	Nov. 2
337	Adult	Male	7-4/16	Hagerman	Nov. 4
338	Adult	Male	6-9/16	Hagerman	Nov. 4
339	Juvenile	Female	5-10/16	McDougall	Nov. 4
340	Adult	Female	5- 9/16	McDougall	Nov. 4
341	Adult	Female	5-11/16	Hagerman	Nov. 4
343	Adult	Male	6-14/16	Foley	Nov. 8
344	Juvenile	Male	6-11/16	Foley	Nov. 8
345	Juvenile	Female	5-8/16	Foley	Nov. 8
346	Adult	Female	5-4/16	Hagerman	Nov. 11
347	Adult	Female	5-6/16	Foley	Nov. 15

TABLE VIII
Cont'd

Specimen #	Age	Sex	(Inches) Tail Length	Township	Date
349	Juvenile	Female	5-5/16	Hagerman	Nov. 21
350	Juvenile	Male	6-6/16	Hagerman	Nov. 23
378	Juvenile	Female	5-8/16	Joly	Oct. 27
381	Juvenile	Female	5-8/16	McDougall	Dec. 3
382	Juvenile	Female	5-2/16	McDougall	Dec. 3
383	Adult	Male	6-10/16	McKellar	Dec. 3
400	Juvenile	Female	5-2/16	Boulter	Nov. 26
401	Adult	Male	6-11/16	N. Himsworth	Nov. 26
402	Juvenile	Male	7	McDougall	Dec. 14
409	Adult	Female	5-7/16	Pringle	Nov. 24
410	Adult	Male	6-8/16	Hardy	Dec. 4
411	Adult	Female	5-6/16	Hardy	Dec. 4

TABLE IX

AVERAGE LENGTH OF RETRICE

# Specimens	Average Length	Range in Inches
23 Male (151-7/16)	6-9/16	6-1/16" - 7-4/16"
23 Female (124-6/16)	5-6/16	5-2/16" - 5-12/16"
* 3 Female specimens with blood quills omitted from above		

TABLE X

SUMMARY OF AVERAGE LENGTH OF RETRICE FOR POSITIVELY SEXED BIRDS 1960, 1962, 1963

	Male			Female		
	# Specimens	Avg. Length	Range	# Specimens	Avg. Length	Range
1960	11	6-6/16	5-14/16 - 6-10/16	9	5-4/16	5- 5-8/16
1962	10	6-5/16	6- 6-10/16	14	5-8/16	4-14/16 - 6-6/16
1963	23	6-9/16	6-1/16- 7-4/16	23	5-6/16	5-2/16 - 5-12/16
	44	6-7/16	5-14/16 - 7-4/16	46	5-6/16	4-14/16 - 6-6/16

* It is interesting to note that only one bird (Specimen #320 of 1962) exceeded the limits as per the Wisconsin criteria. This bird having all the characteristics of a male and measuring 6-6/16" tail feather length, was sexed internally as a female.

Spruce Grouse

Wings and tails from four adult male spruce grouse were submitted by hunters in 1963. These were taken in Chisholm (1), Laurier (1) and Ballantyne (2) Townships.

Acknowledgments

The kind co-operation of the individual sportsmen and conservation officers who submitted specimens and hunting data which made this report possible is greatly appreciated.

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THE DEER SITUATION ALONG THE NORTH SHORE OF LAKE HURON AND GEORGIAN BAY*

by
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Abstract

This paper traces the changes that have occurred in the forests of the North Shore of Lake Huron and Georgian Bay and their effect on the deer population. In order to reconstruct the picture of deer numbers, the early history of logging and pulpwood operations in the Central Region is discussed. Evidence points to a movement of deer from Michigan into the Sault Ste. Marie region in the 1880's. Following extensive cutting operations deer became plentiful in the cut over areas by about 1910, and reached a peak in the 1930's. The decline started in the 1950's.

Along the North Shore of Lake Huron and Georgian Bay lies a thin strip of land that today is called "the deer slums of Ontario." This land has not always supported a deer herd nor has it always been marginal for the production of deer.

Deer were very plentiful along the North Shore during the days of the depression and during the war years of the 1940's but they were also absent from this area during the early period of settlement in the late 1800's. Today, in the 1960's, we are faced with a scarcity of deer in Sault Ste. Marie, Sudbury and North Bay and to provide the reasons for this, it is necessary to construct a history of the changes that have taken place in the forests and their related wildlife populations. It is necessary to consider not only the deer populations but the environment in which they lived in the past, live in the present and will live in the future if the problem is to be fully understood. It is therefore, not a problem of a single species but a problem of a community and its environment. If one member fails to do its job, others suffer, and a new member may move in. Here, in the Sault Ste. Marie - Sudbury - North Bay area the forest is failing to provide adequate food and cover for our deer herds and the deer are suffering.

*A paper (abridged) presented at the 1962 Algonquin Zone 2, Ontario Federation of Anglers and Hunters Massey Conservation Workshop.

Today it appears that man is a dominating factor in much of this area. Many of the older residents of the North Shore can look back upon many of the changes brought about by man. Settlement has increased, farms have been cut out of the bush, lumber industries have moved in (and because of the subsequent changes in the forest some have ceased to operate), mines have been located and smelters constructed, new industries have appeared, the human population has multiplied and indirectly, because of man, the deer herd has diminished in size.

While the decline of the deer herd is fairly well documented by newspaper accounts and the records of this Department, the early history is scattered and scanty. Old geological and land survey records have been searched, the archives of the Jesuit seminaries examined and early settlers still living in the area questioned for information that may lead to a detailed picture of the area's former forest and wildlife complex. One of the best sources of forest information was given to us by a former District Forester, Mr. Tom Thorpe. Prior to his retirement, Mr. Thorpe compiled a review of the logging and pulpwood operations in the Sudbury District during the years 1901-1950, (1). During a recent visit to the Sudbury District Office he supplied additional material on the moose, deer and caribou herds of an area including Sudbury, Chapleau and Gogama Forest Districts. This, with the knowledge gathered from the previously mentioned sources, forms the basis of this report.

Before beginning the history of the deer in the Central Region, a consideration should be made of the early conditions found and the resultant changes brought about by early settlement in the lake states of the U. S. A. to provide a basis for our theory of how deer entered the region. Most of the lake states and the states bordering Canada to the southeast have prepared fairly detailed records of their early settlement, early wildlife populations and the changes that have taken place in both of them. We have drawn on only two of them for this report - Wisconsin and Maine, but the picture presented by the rest of the states complements the facts the two provide.

Dahlberg and Guettinger (2), while dealing with the Wisconsin deer herd indicate that the original distribution and density of the white-tailed deer was undoubtedly related directly to Wisconsin's original habitat. The extensive virgin forest of northern Wisconsin was composed, for the most part, of big timber. The forest floor under these tall trees was relatively bare of vegetation because the heavy canopy of leaves prevented much sunlight from reaching the ground. Thus they assumed that the northern range of the white-tailed deer was considerably smaller than it is today.

Early historical records suggest their assumption to be correct. Lapham (3), in his book "Wisconsin", reports that Indians in the northern portion of the state lived almost exclusively on fish due to a lack of game animals and the absence of agriculture. Shiras (4), in a consideration of wildlife in the Lake Superior region, reported that in 1870 only a few deer were found along the south shore of Lake Superior. This information immediately suggests the question "Where did the deer that now inhabit northern Wisconsin come from and why did they move in?" Rodolf (5), in his review of the early pioneer days in this region, suggests the answer when he examines the conditions found in the southern portion of the state which borders on a prairie-type habitat. In the south he reports the country was full of game and deer were numerous. With the beginning of settlement, logging and subsequently fires in the northern portion of the state, the deer of the south pushed north to the shores of Lake Superior and Lake Michigan.

A similar record of range expansion is available from the state of Maine. Banasiak (6) reports that while deer were commonly found along the coast and up the major river valleys, they were virtually absent from the interior. He cites the lack of necessary food under the mature forest canopy and the restrictive snow depths of the interior as the factors limiting any invasion by the coastal deer. Banasiak goes on to point out that with the new lumbering activities and land clearing by settlers new shrub growth resulted. Burning was a practice commonly used by the settlers. They would burn a patch and plant it the following year with crops. Seldom did they plant the same patch on two consecutive years, but let the patches grow into brush. This pattern resulted in nearly ideal combinations of food and cover for the white-tailed deer. The expected expansion of Maine's deer range and an increase in the herd size followed.

The changes in habitat recorded for Wisconsin and Maine represent the pattern that followed the early settlers west and north from the New England states. In different areas different food and cover species were involved but the ultimate result was the same - areas that had no deer before settlement now support large populations and areas that supported some deer range saw the range expand.

Peterson (7), in his consideration of the changes in the mammalian fauna of Ontario, mapped the northward expansion of the white-tailed deer in Ontario. What we now consider to be the northern limit of deer range is far south of their northern penetration. The Chapleau District, for example, still supports a few deer and Swastika District, which is more than 100 miles north of North Bay, still provides a huntable deer herd. This latter case is undoubtedly due to the farming settlement of this area and its unique habitat.

It was previously noted that many interesting facts on the early history of the regions' forests have been obtained from former District Forester, Tom Thorpe. Mr. Thorpe, in his records of early lumbering provided us with a remarkable picture of how the forest of the Central Region has changed since 1900. It is from his paper that most of the following information was abstracted.

The size of the industry might be measured by the manpower present in the bush during the early years. In the Massey area, for example, 2000 loggers were on the payroll, a similar number were working out of Webbwood which is 10 miles east of Massey and 1200 men were employed during the period 1901-1915 in the forests about the village which is now called Nairn Centre. 200 men were employed seven months of the year 15 hours a day from break-up to freeze-up just sorting logs at the Spanish boom. Twelve large saw mills operated within a radius of 50 miles of the mouth of the Spanish River. Many of the mills ran night and day for several seasons. Rafts of logs containing up to three million feet of timber were towed from the mouth of the Spanish River to Sarnia. These operations were taking place just after the turn of the century and continued at full pace well into the 1920's.

During one season, one company took 20 million feet of white and red pine sawlogs off Capreol Township alone. Similarly, one township near Nairn Centre produced for one company 93 million feet of white and red pine sawlogs between 1910-1924. In the Lake Penage area, a company removed 114 million feet of white and red pine from three townships. To make this figure more impressive it should be appreciated that one of the three townships is 50 per cent water and the other two show a liberal coverage of lakes. One hundred and sixty-two million feet of white and red pine, nine million feet of jack pine, 2-3/4 million feet of spruce and 100,000 feet of tamarack were removed by one company from a portion of what has been termed the French River deer range.

Considering for a moment pulpwood operations, one of the area's earliest operators removed one million cords of spruce pulpwood, 20,000 cords of balsam fir, more than a million jack pine railway ties and 40,000 car stakes between the years 1901 and 1928.

In summary, it has been calculated that between 1901 and 1930, two billion, 520 million feet of sawlog timber were taken from the Sudbury District alone, without taking into consideration pulpwood operations, railway ties, and cedar poles.

To bring us up-to-date it might be well to consider the woods operation in the Sudbury District today and compare it to the past. About 13,000,000 board feet of sawlogs were cut last year compared to the thirty year average (1901-1930) of 84,000,000 board

feet per year. Last year about 54,000 cords of pulpwood were harvested in the Sudbury District compared to the 28 year average of one operator of about 35,000 cords per year. The estimated number of men employed in the bush last year for all of the Sudbury District was about 700 men compared to the 2,000 loggers who were employed in the Massey area alone just after the turn of the century.

It should be noted that it is not our intent to leave the impression that Sudbury District was the centre of all timber operations, but the practice of large scale tree removal was typical across the North Shore of Lake Huron from Sault Ste. Marie and inland to North Bay. These operations followed previous cuttings to the south in Parry Sound and Pembroke Districts.

The picture presented by these statistics, we hope, will give some idea of the differences that you or I or the deer might have encountered had we been present in the Central Region 50 to 75 years ago. With this picture in mind, we will consider the deer family and its story of establishment in the Central Region. It is recognized by most people that the woodland caribou is a resident of the mature forest where lichen growth predominates. The early settlers on Manitoulin Island (around 1875) report a mature forest with caribou present, but no deer. Caribou were also reported along the North Shore but they slowly retreated with the advancement of lumbering operations. The last caribou shot on Manitoulin Island was taken in the winter of 1903. A few bands of caribou were reported by the Sault Ste. Marie game overseer near Oba in 1914. Similar reports from Chapleau and Gogama were made about this time, as the caribou were generally retreating northward.

Moose were present on Manitoulin Island during early settlement but were never numerous. The moose herd gradually diminished in numbers, until today, we rarely hear of reports of moose and never see them on the Island. After the turn of the century moose were generally considered plentiful along the North Shore from Sault Ste. Marie to North Bay. There are indications that the moose population of this area increased through the early part of the century until the 30's when a decrease was noted. In 1938 the season for hunting moose was closed and since that time there appears to have been a decided increase in their numbers and today we have liberalized our seasons considerably, based on this increase.

Deer were not present on Manitoulin Island and along the North Shore of Lake Huron and Georgian Bay according to the Jesuit records (1850-1875). To determine when and how they arrived in this region, we can look to our nearest neighbouring lake state, Michigan. Bartlett (3) describes deer as being scarce in the Upper Peninsula of Michigan previous to 1850. However, after logging

operations, which were under way in the 50's the deer moved north and were recorded as plentiful by 1870. It was probably at about this time that the white-tailed deer moved farther north into Sault Ste. Marie and across Drummond Island to Cockburn Island and finally on to Manitoulin Island in 1880. The first record of deer we have for the Sault area is 1887 and deer tracks were first seen on Manitoulin Island. Unfortunately our knowledge of the area south and east of North Bay is limited and our assumption that the deer of this area originated from the south central area of Ontario (Parry Sound, Lindsay, Pembroke) is purely speculation. Our first note of deer in the Nipissing region is from the Provincial Land Surveyor's records which suggest deer were present as early as 1890.

The build up of deer on Manitoulin Island and along the North Shore, as reported by the game overseers for the Central Region, suggest that at first the increase was slow and spotty gaining momentum about 1910 and reaching its peak in the 30's. This level was held for about ten years and in the 50's a decline started, slow at first, but with the severe winters of 1958-1959 and 1959-1960 the descent became speculative.

Evidence that the build up of deer was a direct result of lumbering operations and subsequent fires was pointed out to us by Mr. Thorpe while discussing the logging of the Nairn Centre area. The removal of red and white pine, spruce and tamarack in this area was carried out first north of the Canadian Pacific Railway. By 1901 deer were plentiful in the cut over area and were hunted by loggers. South of the railroad deer were virtually absent and the mature forest was yet to be cut. It wasn't until the 1920's that this area was cut and by 1940 the picture had reversed itself. South of the railroad deer were plentiful and to the north scarce.

It is hoped that this report on the early history of the Central Region's deer herd and its changing environment will impress upon you that the conditions with which we are dealing today are not similar to those of the past nor will those of the future be the same. If we can modify our thinking about wildlife and accept the fact that we are living with a wildlife population which has been modified by man's actions and will continue to be affected by man-made changes then we will have made a start at conservation.

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SUGGESTIONS FOR WILDLIFE HABITAT IMPROVEMENT

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Abstract

This paper is intended to give an introduction into the subject of wildlife habitat improvement. Information is given on establishing conifer and hardwood plantations and the planting of upland areas for crops, pasture, shrub rows and mast. Submergent and emergent aquatics are discussed and a reference list of plants is provided, cross indexed for the wildlife species which would most likely benefit from the planting. Other subjects mentioned are den and nesting boxes, ditching, impounding and clearing. An extensive bibliography offers suggestions for further reading on this subject.

Introduction

The suggestions contained herein for improvement practices for wildlife are not intended to offer a complete or full treatment of wildlife management practices. They are rather intended to provide a convenient starting point for work of this nature. The information has been secured mainly from the appended list of references, from which more complete information can be obtained. Most of the appended references themselves have bibliographies for still additional information.

The information has been arranged in the following order.

(1) Establishing conifer plantations
(2) Establishing hardwood plantations
(3) Cultivated crop areas
(4) Pasture crop areas
(5) Shrub row plantings
(6) Mast plantings
(7) Submergent aquatics
(8) Emergent aquatics
(9) Den and nesting boxes and platforms
(10) Ditching
(11) Impounding
(12) Cutting, pruning and clearing.

For those improvements requiring planting a reference list of plants is provided, cross indexed for the wildlife species which would experience benefit from the planting of particular plant species. In the tables, F indicates value for food, and C value for cover. Double notation indicates food or cover of particular benefit. Provided as well is a list of scientific and common names of the plant species listed, along with some broad site preferences for each species and individual considerations such as danger to livestock or agricultural crops.

Wildlife species considered are:

- cottontail rabbits
- snowshoe hare
- European hare
- ring-necked pheasant
- ruffed grouse
- Hungarian partridge
- bobwhite quail
- white-tailed deer
- squirrels
- beaver
- muskrat
- woodcock
- waterfowl

The lumping of waterfowl may cause some consternation, since many species with somewhat variable environmental preferences are included. This same problem occurs to a large degree even when only one species is considered, as most animals have seasonally and even daily environmental preference changes, e.g. breeding vs. nesting, vs. feeding, vs. loafing cover, and summer vs. winter requirements. To help overcome this obvious difficulty with a plan of this type, variety both within and among individual improvements cannot be over stressed.

Prior to the implementation of these proposals, consideration should be given to what species of wildlife are to be managed on the area. Following this, a detailed map of the area showing topography, existing morphometrical features, (streams, ponds, roadways, fence rows, coniferous and deciduous cover etcetera), and distribution of sites (drainage, land form, soil types), and the areas of each should be prepared. The wildlife improvements, their location, type, and area, can then be shown on the map, and an accompanying list of plant species, considering wildlife species and site, can be prepared. Before this plan is implemented, the map indicating the proposed improvements should be examined by wildlife personnel.

Finally, this material should be prepared in loose leaf form to facilitate the numerous additions of information which can be expected as experience accumulates. Some measure of actual success in the form of a greater production or harvest of wildlife is desirable, if the program is to be justified. Also if the program is to be developed on a realistic scale, nursery sources of wildlife plants and funds for the installation and maintenance of improvements will be required as well as funds for extension services.

General

(1) Provide variety. Cover and food requirements vary seasonally with wildlife species. Those requirements which are present in the least quantity and quality will limit the production of wildlife even though other requirements may be excessively present. Interspersion of varieties of habitat types helps to insure efficient use by wildlife.

(2) Avoid maturity of vegetation. The wildlife species considered here reach greater densities in what are usually considered to be early successional stages, with due consideration to variety.

(3) Wildlife improvements numbered III, IV, and V are of greatest importance and should be included in all wildlife planning. Improvements numbered I and II would be expected in all cases, since timber production is likely to be involved. Improvements numbered X and XI are desirable, but are not likely to be possible in all cases. Improvements listed under number XII are likely to be required on all established forested areas.

I Establishing Conifer Plantations

(wildlife species - tree species cross references given under shrub row planting chart.)

Applicable to old field areas or areas devoid of cover.

(1) Limit conifer stands to 10 acres or less.
(2) Space trees 10 x 10 feet.
(3) Stands to be rectangularly shaped, or some other shape to create a maximum amount of "edge".
(4) Lay out the whole plantation in a checkerboard design, using rectangular spaces. Alternate spaces to be used for wildlife and timber production.
(5) Do not plant sloughs, marshes, stream banks, orchards, areas of dense brush, or fence rows to conifers. Leave individual apples, hawthorns, cherries, and similar hardwoods as they may occur on the area to be planted.
(6) Mix conifer species and ages within the stands and over the whole plantation.
(7) Plant one or two rows of spruce around pine stands.

II Establishing Hardwood Plantations

(wildlife species-tree species cross references given under shrub row planting chart).

Applicable to old field areas, or areas devoid of cover.

(1) Limit hardwood stands to 10 acres or less.
(2) Stands to be rectangularly shaped, or some other shape to create a maximum amount of edge.
(3) Lay out whole plantation in a checkerboard design, using rectangular spaces. Alternate spaces to be used for wildlife and timber production.
(4) Do not plant sloughs, marshes, stream banks, orchards, conifer copses, or fence rows to hardwoods. Leave individual conifers as they may occur on the area to be planted.
(5) Mix hardwood species and ages within the stands, and over the whole plantation.
(6) Plant one or two rows of spruce around hardwood stands.

III Cultivated Crop Areas

Applicable to rectangular spaces left in conifer and hardwood plantations, areas in plantations where trees failed to survive, fireguards, roadways, in vicinity of ponds or areas created especially for this purpose by bulldozing, cutting.

(1) Have soil tested to determine what fertility treatments will be required.
(2) Cultivated crop areas to be between one and five acres in size.
(3) Areas to be rectangular or some other shape to create maximum amount of edge.
(4) Individual crop areas can be sown to a single crop or mixed crops.
(5) Semi harvest crops, i.e. cutting and raking, stooking, etcetera.
(6) Will require annual re-seeding.
(7) Corn, seed at 3.0-3.5 bushels per acre.

barley	3.0-4.0
winter wheat	2.5-3.0
spring wheat	2.2-2.8
millet	2.0-3.0
buckwheat	1.5-2.0

IV Pasture Crop Areas

Applicable to rectangular spaces left in conifer and hardwood plantations, areas in plantations where trees failed to survive, fireguards, roadways, in the vicinity of ponds, or in areas created especially for this purpose by bulldozing, cutting.

(1) Have soil tested to determine what fertility treatments will be required.
(2) Pasture crop areas to be between one and five acres in size.
(3) Areas to be rectangular or some other shape to create a maximum amount of edge.
(4) Individual areas to be sown to mixed crops.
(5) Except for areas intended for use by nesting waterfowl, pasture crops should be mowed at least once or twice per year, preferably late in the summer. Light grazing could be used to replace mowing. Leave at least 25' around duck nests unmowed.
(6) pasture crop areas may require re-seeding on about a five year basis, depending upon pasture species selected.

V Shrub Row Plantings

Applicable to borders of cultivated and pasture crop areas, surrounding conifer and hardwood plantations, roadsides, fireguards, stream banks, pond borders.

(1) Select shrub species which have most chance of survival on the particular site, with consideration of the wildlife species expected to benefit.
(2) Vary the distribution of shrub species within the planting. Coniferous species should be interspersed in the shrub row planting in locations where coniferous cover is lacking, or place the conifers to form the centre of the row.
(3) Initial plantings should be dense enough to supply fairly short term benefits.
(4) Once established, some additional planting may be required. Spraying with herbicides at breast height can increase suckering of species such as mountain maple. Selective cutting to increase suckering or to remove mature stems would likely be required in well established shrub row plantings.

VI Mast Plantings

Of limited value for wildlife except for the production of deer, squirrels, and some upland game birds such as grouse or turkeys, with squirrels perhaps the major species. Perhaps mast plantings would be of greater benefit if used to increase the variety in shrub row plantings.

The minimum numbers of mast trees required to keep one gray squirrel 34 weeks in an average mast year are given in the following table (ref. Uhlig, H.G., 1956).

D.B.H.	Chestnut oak	White oak	Red oak	Black oak	Scarlet oak
10	73	94	165	60	26
12	22	47	30	39	17
14	13	24	11	29	12
16	11	15	7	24	8
18	8	10	5	19	5
22	7	6	4	14	4
26	6	5	5	11	4
30	6	5	7	9	4

VII Submergent Aquatics

Applicable to ponds, ditches, marshes. Although submergent aquatics will likely quickly become established in new ponds, introductions of the species listed will insure representation of some species of benefit to wildlife. Plants should be selected from similar aquatic environments, including climate, water fluctuation, depth, current, turbidity, chemical composition, bottom characteristics, and soil type.

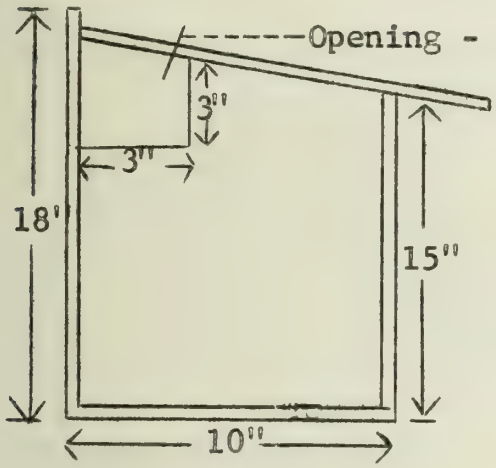
VIII Emergent aquatics

Applicable to pond borders, ditch banks, marshes and bogs. As in the case of submergent aquatics, some introductions will insure some representation of desirable species and variety. Also plants should be selected from similar aquatic environments.

IX Den and nesting boxes and platforms

Applicable to situations where these types of cover are lacking and difficult to supply.

(1) Squirrel nesting boxes.



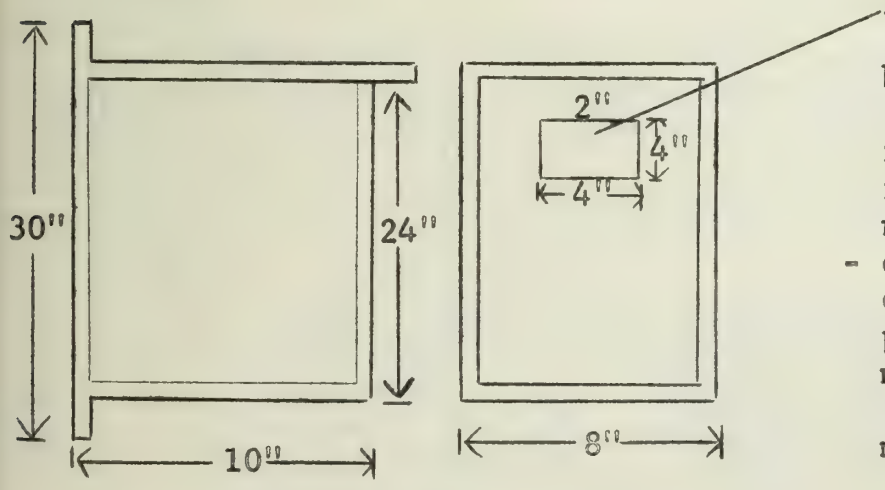
width 8"- hinged bottom for seasonal servicing.

SIDE VIEW

-erect on trees at least 10" DBH
-20-30' from ground
-opening adjacent to tree
-require cleaning every 2-3 years

(2) Wood duck nesting boxes.

Applicable to trees or stubs with bases in water, or prominent trees on shorelines of ponds and small marshes.



ENTRANCE HOLE

bottom hinged for seasonal servicing; place five one quarter inch holes in bottom for drainage of nest materials.

- over the 4" square (or diameter) entrance hole, place a piece of sheet metal. Cut an oval (5" x 4") opening in the metal.

SIDE VIEW FRONT VIEW

- place nesting boxes about 4' above water.
- place conical raccoon guard (metal construction) between box and water.
- boxes should face water.
- remove all branches and shrubbery from approach to the box.
- place box in conspicuous location.
- place 2" of shavings in box for nesting material.

(3) Aerial goose nesting platforms.

- platforms 30" long, 26" wide, and 6" deep, resembling a planter in construction.
- place soil and duff in platform.
- erect platforms at heights between 20-50' on shorelines, or on islands.
- select secluded sites, not likely to be subject to human interference.
- replenish soil and duff annually.

(4) Cottontail Brush Piles

- construct brush piles 12-15' in diameter, and 5' in height.
- locate brush piles near shrubby growth, pasture, creeks, ponds, fence rows.
- if available, brush piles can be constructed over logs, bricks, stone foundations, culvert pipes, similar waste materials.
- allow uncontrolled growth of herbage around brush piles.

X Ditching

Applicable to poorly drained lowlands, sedge meadows, bogs, sluggish streams. Although primarily of importance for muskrats, most wildlife species will benefit.

- lay out ditch in following design.

- no more than 300 feet of ditch in a straight line.
- spoil banks not more than 40 feet long, and staggered on opposite sides of the ditch.
- ditch 5' in depth, and 13-15 feet long.
- space ditches 50 to 100 feet apart.
- plant banks to grass, sweet clover, shrub row plantings, and emergent aquatics.

XI Impoundings or Digging Ponds

Applicability dependent on site; i.e. water supply, impervious soils, ease of dam construction, and other engineering considerations.

(1) Ponds for fish must have minimum size requirements as follows:

- area, not less than one acre, larger for warm water ponds.
- depth, not less than 15 feet maximum depth.
- pond must be completely drainable.

(2) Wildlife Ponds

- area: preferably over one acre, although some wildlife benefit is likely to result from smaller ponds.
- depth: not critical; should have perhaps 4' depth at spillway.
- water control structure is desirable for aquatic vegetation control.
- in large impoundments, numerous islands (either constructed or natural,) increase benefit to waterfowl.
- concrete box spillway with fitted splashboards is usually the most satisfactory discharge and water control structure. Metal pipe through earth filled dyke to handle run off. Emergency grassed spillway should be provided around the pond.
- sides of impoundment should be gently sloped for emergent aquatic establishment.

XII Cutting, Pruning, Clearing

Applicable to the establishment of areas for cultivated or pasture crops within existing timbered sites. Pruning of shrubbery to promote sucker growth or rejuvenate shrubbery.

- Shrub row species which are approaching maturity can be pruned or sprayed at breast height to promote greater ground level growth.
- Pruning of conifers along edges should be avoided.
- Cleared areas for cultivated and pasture crops should be undertaken along the lines mentioned under items I and II.
- Release cuttings may assist in opening dense canopies which are supressing or shading out desirable vines, shrubs, and grasses.

- Cuttings can be made part way through stems of poplars, hawthorns, conifers, leaving the bark intact on one side. The trees are then bent over, so that the tops rest on the ground. Excellent wildlife cover results.

CULTIVATED CROP CHART

Plant Species	Cottontail Rabbit	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Woodcock Beaver Muskrat	Waterfowl
Corn Zea mays	FFC		F	FFC		FFC	FFC	F	FFC		F
Buckwheat Fagopyrum sagittatum	FC			FC			FC				FF
Buckwheat F. tataricum	FC			FC			FC				FF
Sorghum Sorgum vulgare				FC				F			
Sorghum S. halepense				FC				F			
Barley Hordeum vulgare	F	F	F	F							
Wheat Triticum aestivum	F	F	F	F		1/ FF	F	1/ F			FF
Rye Secale cereale	F	F	F	F							
Millet Panicum miliaceum				F			F				FF
Oats Avena sativa	FC	F	F	F			F				F
Flax Linum usitatissimum				F							
Sunflower Helianthus spp.	F			F							

1/ Fall wheat

PASTURE CROP CHART

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Woodcock Beaver	Waterfowl
Canada bluegrass *Poa compressa*	FFC	F	FC	FC	F	FFC	FFC	F				CC
Kentucky bluegrass *P. pratensis*	FFC	F	FC	FC	F	FFC	FFC	F				CC
Timothy *Phleum pratense*	FC		C	C	F	FC	FC					C
Witch grass *Panicum spp.*	C		C	C		C	FC					FC
Orchard grass *Dactylis glomerata*	C		C	C		C	C					C
Brome *Bromus inermis*	FC		FC	FC	F	FC	FC					CC
Red top *Agrostis alba*	C		C	C	F	C	C					CC
Reed canary grass *Phalaris arundinacea*	FC			C		C	C			FFC		C
Red clover *Trifolium pratense*	FF	FF	FF	F	F	F	FF	F				C
White clover *T. repens*	FF	FF	FF	F	F	F	FF	F				C
Alsike clover *T. hybridum*	FF	FF	FF	F	F	F	FF	F				C
Rabbit foot clover *T. arvense*	FF	FF	FF	F	F	F	FF	F				C
Sweet clover *Melilotus spp.*	FFC	FFC	FFC	FC		FC	FC	F		F		CC
Alfalfa *Medicago sativa*	FFC	FFC	FFC	FC		FC	FC	F				C
Birdsfoot trefoil *Lotus corniculatus*	C			C		C	C					
Vetch *Vicia spp.*	FC			FC		FC	FC					C
Barnyard grass *Echinochloa spp.*	C			C		FC	FC					FC
Slough grass *Bechmannia syzigachne*	C			C								FC
Hairgrass *Deschampsia spp.*	C			C								FC

SHRUB ROW PLANTING CHART

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Beaver	Woodcock	Waterfowl
Dogwood *Cornus* spp.	FC	FC	FC	FC	F	C	CC	FF	C			C	
Bramble *Rubus* spp.	FFC	FFC	FC	FC		C	C						
Ironwood *Ostrya virginiana*	F	F	F		F			FC					
Sweet-fern *Comptonia peregrina*	FC												
Poplar, aspen *Populus* spp.	FFC	FFC	FFC	C	FFC	C	C	FC			FF	C	
Birch *Betula* spp.	FFC	FC	FC	C	FC	C	C	FC			FF	C	
Alder *Alnus* spp.	FC	FC	FC	C		C		FC			FF	C	
Sumach *Rhus* spp.	FC	FC	FC	FCC	FC	FC	FC	FF					
Plum, cherry *Prunus* spp.	FFC	FFC		C	FC	C	C	FF	C		F		
Maple *Acer* spp.	FFC	FFC		C	FC			FFC	FFC		F	C	
Honey locust *Gleditsia triacanthos*	FFC		FC	C	FC	FC							
Locust *Robinia* spp.	FC		FC	FC	FC	FC	FFC		C			CC	
Elm *Ulmus* spp.	FC	FC	FC	C	FC			FC	C				
Hackberry *Celtis occidentalis*	FC			C									
Common elder *Sambucus canadensis*	C		C	C	C		CC	FC					

SHRUB ROW PLANTING CHART (Cont'd)

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Beaver	Woodcock	Waterfowl
Willow *Salix* spp.	FC	FC	FC	C	FC	C	C	FC			F	C	C
Hawthorn *Crataegus* spp.	FFC	FFC	FFC	C	FC			F					
Rose *Rosa* spp.	FFC	FC	FC	FC			FC						
Winterberry *Ilex verticillata*	FC			FC									
Bittersweet *Celastrus scandens*	C			FC									
Virginia creeper *Parthenocissus* spp.	CC		C	C			CC						
Grape *Vitis* spp.	CC		C	C			CC						
Basswood *Tilia americana*	FC	FC	FC					FC	CC				
Honeysuckle *Lonicera* spp.	FC	FC		FC	FC		CC					CC	
Snowberry *Symphoricarpos* spp.	FC	FC	FC	FC	FC		FC	FF					
Viburnum spp.	FFCC	FC	FC	FFC	FC	FC	FC	FC	FC			C	
Barberry *Berberis* spp.	FFC	FC	FC	FC		FC							
Buckthorn *Rhamnus* spp.	F	F											
White cedar *Thuja occidentalis*	FCC	FCC	C	C	FCC	C	C	FCC	C				
Juniper *Juniperus* spp.	FCC	FCC			FC								

SHRUB ROW PLANTING CHART (Cont'd)

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Beaver	Woodcock	Waterfowl
Scarlet pimpernel *Anagallis arvensis*	FC			FC									
Ground hemlock *Taxus canadensis*	F	F						F					
Witch hazel *Hamamelis virginiana*	FC			FC		FC							
Prickly ash *Xanthoxylum americanum*	FCC		FC	CC	FC	CC	CC						
Mulberry *Morus* spp.	FC		FC	FC		FC	FC						
Ash *Fraxinus* spp.	F						FC		C				
Spirea *Spirea* spp.	FCC	FCC	FCC	CC		CC							
Juneberry *Amelanchier* spp.	FC	FC	FC	FC			FC						
Privet *Ligustrum* spp.	FC	FC	FC										
Pear *Pyrus* spp.	FFC	FFC	FFC	FC	FC			FF					
Mountain ash *Sorbus* spp.	FFC	FFC	FFC	FC	FC			F					
Spindle tree, burning bush *Euonymous* spp.	C		C	FC									
Buttonbush *Cephalanthus occidentalis*				FC									C
Pine *Pinus* spp.	FC	FC	FC	C	C			FCC	FC				
Fir *Picea* spp.	CC	CC		C	FCC	C	C	C	FC		F		

SHRUB ROW PLANTING CHART (Cont'd)

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Beaver	Woodcock	Waterfowl
Balsam Abies balsamea	CC	CC		C	FCC	C	C	FC	FC		F		
Currant Ribes	FC	FC						F					
Oleaster Elaeagnus spp.	FCC	FCC	FC	FC	FC	FC	FC	FC	FC				FC

MAST PLANTING CHART

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Muskrat	Beaver	Woodcock	Waterfowl
Hazelnut Corylus americana					F		F	F	F				
Beaked hazel C. cornuta					F		F	F	F				
Hickory Carya spp.								F	F				
Butternut Juglans cinerea								F	FC				
Black walnut J. nigra								F	FC				
Beech Fagus grandifolia	F							F	FFCC				
Oak Quercus spp.	F	F		F	F		F	F	FFC		F		

EMERGENT VEGETATION CHART

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels Beaver	Muskrat	Woodcock	Waterfowl
Wildrice Zizania aquatica												F
Cattail Typha spp.										FFCC		C
Bur reed Sparganium spp.										FC		F
Arrow grass Triglochin maritima												FC
Manna grass Glyceria spp.										C		FC
Leatherleaf Chamaedaphne calyculata												CC
Reed Phragmites communis	C			C			C			C		C
Sweet gale Myrica gale	C											C
Labrador tea Ledum groelandicum												C
Reed bent grass Calamagrostis spp.	C	C								FFC		
Bladderwort Utricularia spp.										FC		
Spike rush Eleocharis spp.												C
Water smartweed Polygonum amphibium										F		FF
Bulrush Scirpus spp.										FC		FC
Tuckahoe Peltandra virginica												FC
Sedges Carex spp.										FC		FCC
Rushes Juncus spp.										FC		FC

SUBMERGENT VEGETATION CHART

Plant Species	Cottontail Rabbits	Snowshoe Hare	European Hare	Ring-necked Pheasant	Ruffed Grouse	Hungarian Partridge	Bobwhite Quail	White-tailed Deer	Squirrels	Beaver	Muskrat	Woodcock	Waterfowl
Hornwort Ceratophyllum demers											F		F
Hornwort C. echinatum											F		F
Pond lily Nuphar spp.													F
Musk grass Chara spp.													F
Duckweed Lemna spp.													F
Water flaxseed Spirodela polyrhiza													
Sago pondweed Potamogeton pectinatus													FF
Pondweed P. natans													FF
Pondweed Potamogeton spp.													F
Eel grass Zostera marina													
Arrowhead Sagittaria cristata											F		F
Duck potato S. latifolia											F		F
Waterweed Elodea canadensis											F		
Water milfoil Myriophyllum spp.											F		
Water smartweed Polygonum amphibium											FF		FF
Pickerelweed Pontederia cordata													
Wild celery Vallisneria american													F

Species	Common Name	Site: Upland	Lowland	Other
Cultivated Crops				
Avena sativa L.	oats	X		
Fagopyrum sagittatum Gilib.	buckwheat	X		
F. tataricum (L.) Gaertn	buckwheat	X		
Helianthus spp.	sunflower	X		
Hordeum vulgare L.	barley	X		
Linum usitatissimum L.	flax	X	X	dangerous to livestock
Panicum miliaceum L.	millet	X		
Secale cereale L.	rye	X		
Sorgum vulgare Pers.	sorghum	X		unhardy to frosts, dangerous to livestock
S. halepense (L.) Pers.	sorghum	X		" "
Triticum aestivum L.	wheat	X		
Zea mays L.	corn	X		unhardy to frosts

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site Upland	Lowland	Other
Pasture Crops				
Agrostis alba L.	red top		X	pH 4.5-6.5
Beckmannia syzigachne (Steud.) Fern.	slough grass		X	
Bromus inermis Leyss.	brome	X		
Dactylis glomerata L.	orchard grass	X		
Deschampsia spp.	hairgrass	X		dry
Echinochloa crusgalli (L.) Beauv.	barnyard grass	X		
E. frumentacea (Roxb.) Link	Japanese millet	X		
E. pugens microstachya (Weig)Fern. & Grisc.	barnyard grass	X	X	
Lotus corniculatus L.	birdsfoot trefoil	X	X	
Medicago sativa L.	alfalfa	X		dangerous to livestock
Melilotus spp.	sweet clover	X		pH5.0-7.0
Panicum spp.	witch grass	X	X	
Phalaris arundinacea L.	reed canary grass		X	
Phleum pratense L.	timothy	X		

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site: Upland	Site: Lowland	Site: Other
Pasture Crops Cont'd				
Poa compressa L.	Canada bluegrass	X		dry
P. pratensis L.	Kentucky bluegrass	X	X	
Trifolium arvense L.	rabbit foot clover	X		dry, dangerous to livestock
T. hybridum L.	alsike clover	X		pH 5.5, dangerous to livestock
T. pratense L.	red clover	X		dangerous to livestock
T. repens L.	white clover	X	X	dangerous to livestock
Vicia spp.	vetch	X	X	

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Shrub Row Plants				
Acer negundo L.	box elder	X	X	stream banks
A. pensylvanicum L.	striped maple	X		
A. platanoides L.	Norway maple	X		
A. rubrum L.	red maple	X	X	
A. saccharum Marsh	sugar maple	X		
A. spicatum Lam.	mountain maple	X	X	woods
Alnus crispa (Ait.) Pursh	green alder	X		rocky
A. incana (L.) Moench.	white alder	X		
A. glutinosa (L.) Gaertn.	black alder	X		
A. rugosa (Du Roi) Spreng	Speckled alder		X	
Amelanchier alnifolia Nutt.	service berry	X	X	stream banks
A. amabilis Wieg.	service berry	X	X	open
A. huronensis Wieg.	service berry	X		
A. sanguinea (Pursh) D.C.	service berry	X		non calcareous
A. wiegandii Nielsen	service berry	X		sandy, rocky

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site: Upland	Site: Lowland	Site: Other
Shrub Row Plants Cont'd				
Anagallis arvensis L.	scarlet pimpernel	X		sandy
Berberis vulgaris L.	common barberry	X		host for stem rust
B. Thunbergii D.C.	Japanese Barberry	X		open (stem rust)
Betula spp.	birch	X	X	species variable
B. lutea Michx	yellow birch	X		
B. papyrifera Marsh.	white birch	X		
Celastrus scandens L.	bittersweet	X	X	stream banks
Celtis occidentalis L.	hackberry	X	X	variable
Cephalanthus occidentalis L.	buttonbush		X	swamps, stream banks
Comptonia peregrina (L.) Coult.	sweet-fern	X		
Cornus alternifolia L.	green osier	X		dry, rocky
C. anomum Mill.	red willow		X	swamps
C. florida L.	flowering dogwood	X		acid woods
C. racemosa Lam.	dogwood	X	X	open
C. rugosa Lam.	round lvd. dogwood	X		dry, rocky

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
C. stolonifera Michx.	red osier dogwood	X	X	
Crataegus spp.	hawthorn	X	X	species variable
Elaeagnus angustifolia L.	Russian olive	X		
E. commutata Bernh.	silverberry	X		dry calcareous
E. multiflora thunb.	oleaster	X		
E. umbellata thunb.	oleaster	X		
Euonymous atropurpureus Jacq.	burning bush	X		
E. europaeus L.	spindle tree	X		
E. obovatus Nutt.	running strawberry bush	X	X	
Fraxinus americana L.	white ash	X	X	
F. nigra Marsh	black ash		X	
Gleditsia triacanthos L.	honey locust	X		
Hamamelis virginiana L.	witch hazel	X	X	woods
Ilex verticillata (L.) Gray	winterberry		X	swamps
Juniperus communis L.	juniper	X		dry (apple rust)
J. virginiana L.	red cedar	X		rocky, host for apple rust)

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Shrub Row Plants Cont'd				
Ligustrum amurense Carr.	privet	X		
L. vulgare L.	privet	X		
Lonicera canadensis Bartr.	fly honeysuckle	X		
L. hirsuta Eat.	hairy honeysuckle	X		calcareous
L. oblongifolia (Goldie)Hook.	swamp honeysuckle		X	bogs, swamps
L. prolifera (Kirchn.) Rehd.	grape honeysuckle	X		rocky
L. tatarica L.	Tartarian honeysuckle	X		
L. villosa (Michx.) R & S	mountain honeysuckle		X	peaty bogs
Ostrya virginiana (Mill.) K. Koch	ironwood	X		
Parthenocissus inserta (Kerner) K.Fritsch	Virginia creeper	X	X	banks
P. quinque folia (L.) Planch	Virginia creeper	X		rocky
Populus balsamifera L.	balsam poplar		X	stream banks
P. deltoides Marsh	cottonwood		X	stream banks
P. grandidentata Michx.	large-toothed aspen	X		dry
P. tremuloides Michx.	trembling aspen	X		dry

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Shrub Row Plants Cont'd				
Prunus americana Marsh	wild plum		X	stream banks
P. nigra Ait.	Canada plum	X	X	stream banks
P. pensylvanica L.	pin cherry	X		dry, dangerous to livestock
P. serotina Ehrh.	black cherry	X		" " "
P. virginiana L.	choke cherry	X	X	dangerous to livestock
Rhamnus alnifolia L'Her	buckthorn		X	swamps (stem rust, livestock)
R. cathartica L.	buckthorn	X		host for stem rust, dangerous to livestock
R. frangula L.	alder buckthorn			(stem rust, livestock)
Rhus glabra L.	smooth sumac	X		dry, either acid or alkaline
R. typhina L.	staghorn sumac	X		dry, rocky

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Shrub Row Plants Cont'd				
Ribes spp.	currant	X	X	species variable
Robinia pseudo-acacia L.	black locust	X		
R. viscosa Vent.	clammy locust	X		dry
Rosa spp.	rose	X	X	species variable
Rubus spp.	raspberries and blackberries	X	X	species variable
Salix humilis Marsh	pussy willow	X		dry
S. interior Rowlee	sandbar willow	X		sandy, waste
S. nigra Marsh	black willow		X	stream banks
S. purpurea L.	purple osier		X	
Sorbus americana (Marsh.)D.C.	mountain ash	X		
S. aucuparia (L.) gaertn.	mountain ash	X		
Spirea alba Du Roi	spirea		X	
S. latifolia (Ait.)Borkh.	meadow sweet		X	
S. tomentosa L.	hardhack		X	

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site: Upland	Site: Lowland	Other
Symphoricarpos albus(L.)Blake	Snowberry	X		calcareous, gravels
S. occidentalis Hook.	wolfberry	X		dry, plains
S. orbiculatus Moench	coralberry	X		dry, poor growth on acid soil
Taxus canadensis Marsh	ground hemlock	X	X	woods
Thuja occidentalis L.	White cedar	X	X	
Tilia americana L.	basswood	X		
Ulmus rubra Muhl.	slippery elm	X	X	calcareous
U. thomasi Sarg.	rock elm	X		calcareous
Viburnum acerifolium L.	maple-lvd. viburnum	X		dry woods
V. alnifolium Marsh.	hobblebush	X		shaded woods
V. cassinoides L.	witherod	X	X	also swamps, very hardy
V. lantana L.	wayfaring tree	X		
V. lentago L.	nannyberry	X	X	stream banks
V. opulus L.	guelder rose		X	

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Shrub Row Plants Cont'd				
V. rafinesquianum Schultes	downy arrow wood	X		dry
V. trilobum Marsh	highbush cranberry	X	X	variable
Vitis spp.	grape	X	X	species variable
Xanthoxylum americanum Mill.	prickly ash		X	stream bank
Abies balsamea(L.) Mill.	balsam fir	X		
Picea glauca (Moench) Voss	white spruce	X		
P. mariana(Mill.) BSP.	black spruce		X	
Pinus banksiana Lamb.	jackpine	X		sandy, rocky
P. resinosa Ait.	red pine	X		dry
P. strobus L.	white pine	X	X	

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Mast Crops				
Carya spp.	hickory	X	X	species variable
Corylus americana Walt.	hazel	X		unhardy
C. cornuta Marsh.	beaked hazel	X	X	
Fagus grandifolia Ehrh.	beech	X		
Juglans cinerea L.	butternut	X		
J. nigra L.	black walnut	X		
Quercus alba L.	white oak	X		dry
Q. bicolor Willd.	swamp oak		X	stream banks
Q. coccinea Muenchh.	scarlet oak	X		dry
Q. macrocarpa Michx.	bur oak		X	
Q. palustris Muenchh.	pin oak		X	swampy
Q. rubra L.	red oak	X		dry
Q. vetulina Lam.	black oak	X		dry

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site: Upland	Site: Lowland	Site: Other
Emergent Aquatics				
Calamagrostis spp.	reed bent grass		X	species variable
Carex spp.	sedges		X	species variable
Chamaedaphne calyculata(L.)Moench	leatherleaf		X	peaty bogs, swales
Eleocharis spp.	spike rush		X	species variable
Glyceria borealis(Nash.)Batchelder	floating manna grass		X	wet or shallow water
G. canadensis(Michx.) Trin.	rattlesnake grass		X	meadows, damp thickets
G. pallida(Torr.) Trin.	manna grass		X	pools, pond margins
G. septentrionalis Hitchc.	floating manna grass		X	swamps,wet woods
Juncus spp.	rushes		X	species variable
Ledum groenlandicum Oeder	Labrador tea		X	bogs
Myrica gale L.	sweet gale		X	shallow water, swamps
Peltandra virginica(L.)Schott & Endl.	tuckahoe		X	swamps, pond borders
Phragmites communis Trin.	reed		X	pond margins, ditches

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site		
		Upland	Lowland	Other
Emergent Aquatics Cont'd				
Polygonum amphibium L.	water smartweed		X	subspecies variable
Scirpus spp.	bulrushes		X	species variable
S. americanus Pers.	three square bulrush		X	marsh, shorelines
S. fluviatilis (Torr.)Gray	river bulrush		X	lake edges, calcareous
Sparganium spp.	bur reed		X	species variable
Triglochin maritima L.	arrow grass		X	marshes, shorelines
Typha angustifolia L.	narrow-lvd. cattail		X	shallow water shorelines
T. latifolia L.	common cattail		X	shallow water shorelines
Utricularia spp.	bladderwort		X	ponds, sluggish water
Zizania aquatica angustifolia L. Hitchc.	wildrice		X	stable shallow water

Species	Common Name	Site
Submergent Vegetation		
Ceratophyllum demersum L.	hornwort	quiet waters 2-15 feet, hard water
C. echinatum Gray	hornwort	quiet waters 2-15 feet, hard water
Chara spp.	musk grass	15-30 feet or less
Elodea canadensis Michx.	waterweed	quiet waters, calcareous
Lemna spp.	duckweed	quiet waters, springs, floating
Myriophyllum spp.	water milfoil	lakes, ponds, streams
Nuphar spp.	yellow pond lily	quiet waters, slow streams
Polygonum amphibium L.	water smartweed	subspecies variable
Pontederia cordata L.	pickerelweed	muddy shores, shallow water
Potamogeton epihydrus Raf.	pondweed	quiet or moving water
P. natans L.	pondweed	ponds, quiet streams
P. nodosus Poir	pondweed	ponds, streams
P. pectinatus L.	sago pondweed	calcareous waters
P. richardsonii(Ar.Benn.)Rydb.	red head pondweed	ponds, streams, calcareous
Sagittaria cristata Engelm.	arrowhead	ponds, sandy bottoms

Check List of Plants for Wildlife Plantings Cont'd

Species	Common Name	Site
Submergent Vegetation Cont'd		
S. latifolia Willd.	duck potato	subspecies variable
Spirodela polyrhiza(L.)Schleid	water flaxseed	ponds, stream margins, floating
Vallisneria americana Michx.	wild celery	quiet water
Potamogeton crispus L.	Curly-lvd. pondweed	best seed prod. in 3-12" water

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